

## A re-investigation on the taxonomy of the genus *Ochlandra* Thw. (Poaceae-Bambusoideae)

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### Abstract

The genus *Ochlandra* Thw., with eight species endemic to Western Ghats of India and one to Sri Lanka, is poorly represented in the herbaria and is taxonomically inadequately understood. This paper is a preliminary revision of the genus and presents an artificial key to the species, complete description and illustrations of the species, based on recent collections in flowers and fruits by the author and consultation of authentic specimens.

### INTRODUCTION

Bamboos are taxonomically one of the most difficult group of grasses. Being forest-dwelling, monocarpic and gregarious-flowering, they have been highly problematic for field studies, collection and classification. Most herbarium specimens are too poor, consisting of bits of either only vegetative or reproductive materials. Consequently, generic and specific delimitations have been in confusion and are based on scanty materials. Thus, the estimated numbers range from 75 genera and 1250 species (Soderstrom, 1985) to 110 genera and 1087 species (Ohnberger and Goerrins, 1990),

Bamboos are among the most rapidly destroyed natural resources all over-the world. Destruction of the forest cover, the natural home of bamboos, and over-exploitation has resulted in great reduction in natural populations, so much so that an ambitious international programme for their conservation and systematic research, are now underway. International Development Research Centre (IDRC), Canada, has been encouraging and funding research programmes on bamboos with active collaboration of local institutions. The KFRI has also been selected as one of the centres for such studies on Indian Bamboos, under which the author has been studying them for the last few years. The present work is a part of it. A complete taxonomic monograph of Indian bamboos is under preparation.

The genus *Ochlandra*, originally described by Thwaites (1864) to accommodate the Sri Lankan *Bambusa stridula* Moon (now, *Ochlandra stridula*), is now

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known to have 9 species, of which 8 are endemic to Western Ghats of southern India and one to Sri Lanka (See map 1). The single species reported from Malaya (*O. ridleyi* Gamble), has since been transferred to *Schizostachyum* (*S. latifolium* Gamble) (Holttum, 1958).

The earliest published description of species of the genus are found in van Rheedee's Hortus Malabaricus (1678—1693), wherein he has described *Ochlandra scriptoria* (Dennst.) Fischer, (5: 119, t. 60. 1685-*Beesha*) and *O. travancorica* (Bedd.) Benth. ex Gamble (5: 119-120. 1685, no plate-*Nola-ily*) (see Nicolson *et al.*, 1988). Almost two centuries later workers like Munro (1868), Beddome (1873), Gamble (1896). Holttum (1958), Raizada & Chatterji (1963), Kumar (1990), Tewari (1992) and Chand Basha & Kumar (1994) have made some contributions to our knowledge of this group commonly called 'reed bamboos'. Unfortunately, most descriptions including recent ones are poor and lacking in details as they are based on scanty herbarium specimens. Moreover, there have been little attempt to recollect and re-investigate the taxa in the field and in the laboratory. As a result, even recent descriptions of these taxa are either copies of the old, or are incomplete.

It is in this context that the author took up a taxonomic re-investigation of the reed-bamboos, with emphasis on field study and fresh collections rather than old herbarium specimens. In this effort, it has been possible also to collect all Indian taxa both in their vegetative and reproductive stages. Some taxa, which were not collected for long, have been relocated and studied. Critical studies have also resulted in emended descriptions of a few species. (Chand Basha & Kumar, 1994).

However, the only exception is *O. stridula*, the Sri Lankan endemic. This species has been included here after seeing the photograph (Cibachrome) of the type specimen at Kew and a single specimen at (MH).

***Ochlandra*** Thwaites, Enum. Pl. Zeyl. 5: 376. 1864.

Type species: *Ochlandra stridula* Moon ex Thw.

Shrubby gregarious reed-like bamboo. Culms small, thin walled, erect with comparatively longer internodes. Culm-sheaths thin persistent; auricles small. Leaves small to moderate-sized, rarely large, linear or oblong-lanceolate, acuminate, shortly petiolate, veins many, margin cartilaginous; leaf sheath striate, fringed ligule short. Inflorescence a terminal spike or spicate panicle on a leafy branchlet. Spikelets in verticels, partly fertile, partly sterile, 1-flowered. Sterile glumes 2—5, variable, usually mucronate. Fertile glume similar to empty glume. Palea membranous, not keeled. Lodicules one to several, conspicuous,

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variable, usually appressed to the filaments. Stamens many, filaments free or monadelphous, exerted, anthers long, mucronate. Ovary narrow; style elongated; stigmas 4—6, plumose, before opening either close together or twisted. Caryopsis large, ovoid, long-beaked, supported by the persistent glumes; pericarp thick fleshy.

**Distribution and ecology :** This genus is widely distributed in the forests of Western Ghats except in grass lands and dry deciduous forests. Eight species and one variety of this genus is endemic to Western Ghats and a single species *O. stridula* is endemic to Sri Lanka (Map 1). The widely distributed and common species which are found growing in abundance are *O. travancorica*, *O. travancorica* var. *hirsuta* and *Ochlandra scriptoria* found along the stream bank in the lower elevation. Of all the reed species, only three species are of high industrial value, while, other species have only local and limited use mainly for basket and mat-making.

Key to the species

- 1. Filaments fused (monadelphous):
  - 2. Lodicules 3 or 4, unequal; stigma plumose, 7 or more upto 9 ..... *O. ebracteata*
  - 2. Lodicules 3, unequal, membranous, apiculate; stigma plumose, not more than 5:
    - 3. Spikelets thickly clothed with light brown velvety hairs..... *O. travancorica* var. *hirsuta*
    - 3. Spikelets glabrous..... *O. travancorica* var. *travancorica*
- 1. Filaments free:
  - 4. Stigma plumose, 5 or more:
    - 5. Lodicules 5 or more:
      - 6. Empty glumes 3 or 4, mucronate, hairy:
        - 7. Leaf smooth on abaxial side and hairy on adaxial side; stigma 5, unequal. *O. setigera*

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- 7. Leaf glabrous on both surfaces; stigma 5, equal... *O. talboti*
- 6 Empty glumes 2, mucronate:
  - 8. Palea blunt; lodicules 5, 2 of them bipartite at apex; anthers bifid at apex..... *O. beddomei*
  - 8. Palea mucronate; lodicules 6, all similar anthers apiculate..... *O. sivagiriana*
- 5. Lodicule single..... *O. wightii*
- 4. Stigma plumose, not more than 3; lodicules 7.....
  - 9. Stamens 27, with 1 or 2 spicules at the apex of the connective..... *O. stridula*
  - 9. Stamens 15—18, anthers mucronate..... *O. scriptoria*

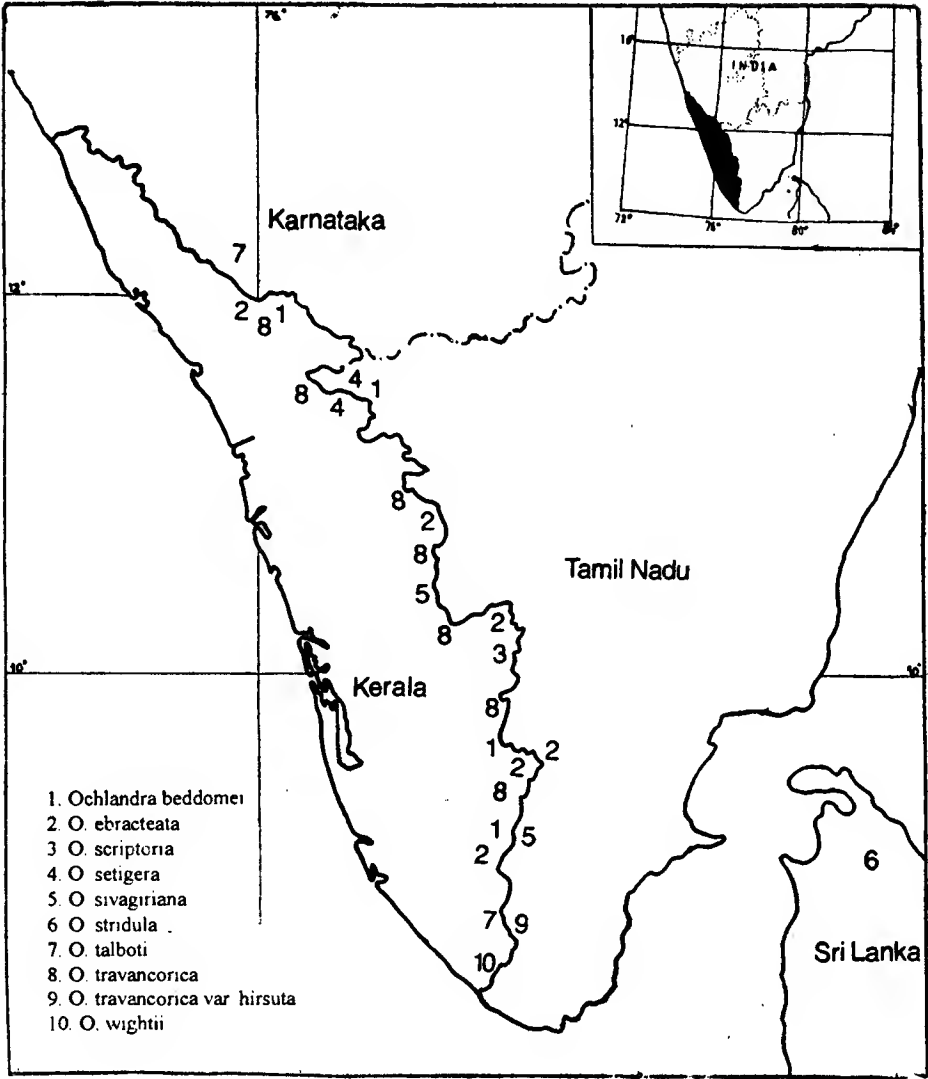
**Ochlandra beddomei** Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 124: 1896 & in Hook. f., Fl. Brit; India 7: 419. 1897; Camus, Les Bambusees 182. 1913; Varmah & Bahadur, Indian For. Rec. (N. S.) Bot. 6 (1): 3. 1980; Tewari, Monogr. Bamboos 115. 1992; Chand Basha & Kumar, Rheedea 4 (1): 25. 1994.

Type: *Gamble* s.n. (K), (Photograph-Cibachrome seen)

(Fig. 1)

Culms erect, often arched, 10—12 m, high; node sparsely pubescent, green; internodes 15—17 cm long, 3—4 cm in diameter. Culm-sheath deciduous, oblong-obtuse, glabrous with a short, lanceolate blade,  $11 \times 3.5$  cm long, progressively smaller towards the culm apex; blade reflexed, horizontal. Leaves narrowly elliptic-lanceolate, 10—14 (—50 cm in seedling)  $\times$  1.5—2.5 cm, rounded or slightly cuneate at base, long-acuminate with a twisted, setaceous tip, smooth above, glaucous below; margins cartilaginous, revolute, scabrid; secondary veins about 8 pairs with a few intermediates. Intermediates 6—7, transverse veinlets none. Petiole 2 to 5 mm long; sheaths auricled and bristly, striate, pubescent, callose at tip; callus with a few erect, stiff, pale bristles; ligules very narrow. Inflorescence terminal spicate panicle on leafy branches or on leafless nodes. Spikelets clustered, 2—3.5 cm long, subcylindric, covered

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Map Showing distribution of *Ochlandra* Spp.

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with scattered, stiff, bulbous-based, brown hairs. Bracts 2—4; sterile glumes 2, basal ovate, often long-mucronate at apex, many-nerved, hirsute; the outer 2 cm long, linear, longer than the inner in flowers, 1—1.5 cm in fruits; fertile glume ovate-lanceolate, mucronate, 2.8 cm long, many-nerved, glabrous in flower, 2.3—3 cm in fruits. Palea membranous, lanceolate-subobtuse, shorter than the fertile glume, 2.6 cm in flowers, in fruits 3 cm long. Lodicules 5, linear, to  $2-2.5 \times 0.2-0.4$  cm, 2—5-nerved, glabrous, 3 of them entire and 2 of them forked at apex. Stamens many, exserted; filaments free; anthers narrow, 1.2—1.6 cm long, bifid at apex, mucronate. Ovary suborbicular with the beak of the perigynium produced in an angular styler sheath, glabrous; stigma 6, plumose, white. Caryopsis  $5 \times 1.7$  cm, supported by the persistent glumes. Pericarp thick and fleshy.

**Distribution:** Endemic to Western Ghats. Rare and localised in distribution.

**Flowering:** Earlier flowering reported in 1875—76. Recently flowers were collected during 1986, 1988 and 1992.

**Uses:** Mainly used for basket making.

**Specimen examined:** Kerala: Wynad Dist., Thariod. *Muktesh Kumar* 6466 (KFRI).

**Note:** There are two specimens, one of Gamble and the other, probably of Beddome at Kew, with no collection details and was presented to Kew in 1925. The other specimen collected from "Nilgiris, 3—4500" bears an annotation by Don. Both are good flowering specimens and the latter is selected as the lectotype.

**Ochlandra ebracteata** Raizada & Chatterji, Ind. For. 89: 362. 1963; Tewari, Monogr. Bamboo 110. 1992.

Type: at DD (seen)

Vern: Valleta (Mal.)

(Fig. 2)

An erect, shrubby or arborescent, clump forming plant, each clump with 60—70 culms. Culms to 4.6 m tall, 2—3.8 cm in diameter; nodes shining green; internodes ca. 45 cm long. Culm-sheath ovate-obtuse,  $13-15 \times 6-11$  cm, covered with appressed, subulate, chocolate brown or black, hairs; blade  $12-15 \times 1.5-2$  cm, lanceolate-acuminate. Ligule 5—9 mm long. Leaves oblong-lanceolate, acuminate at apex, shortly cuneate at base, glabrous on both sides, margins and apices scabrid; petiole 2—10 mm, thick and broad, often twisted; secondary veins 10—15 pairs, intermediates 6—8 with

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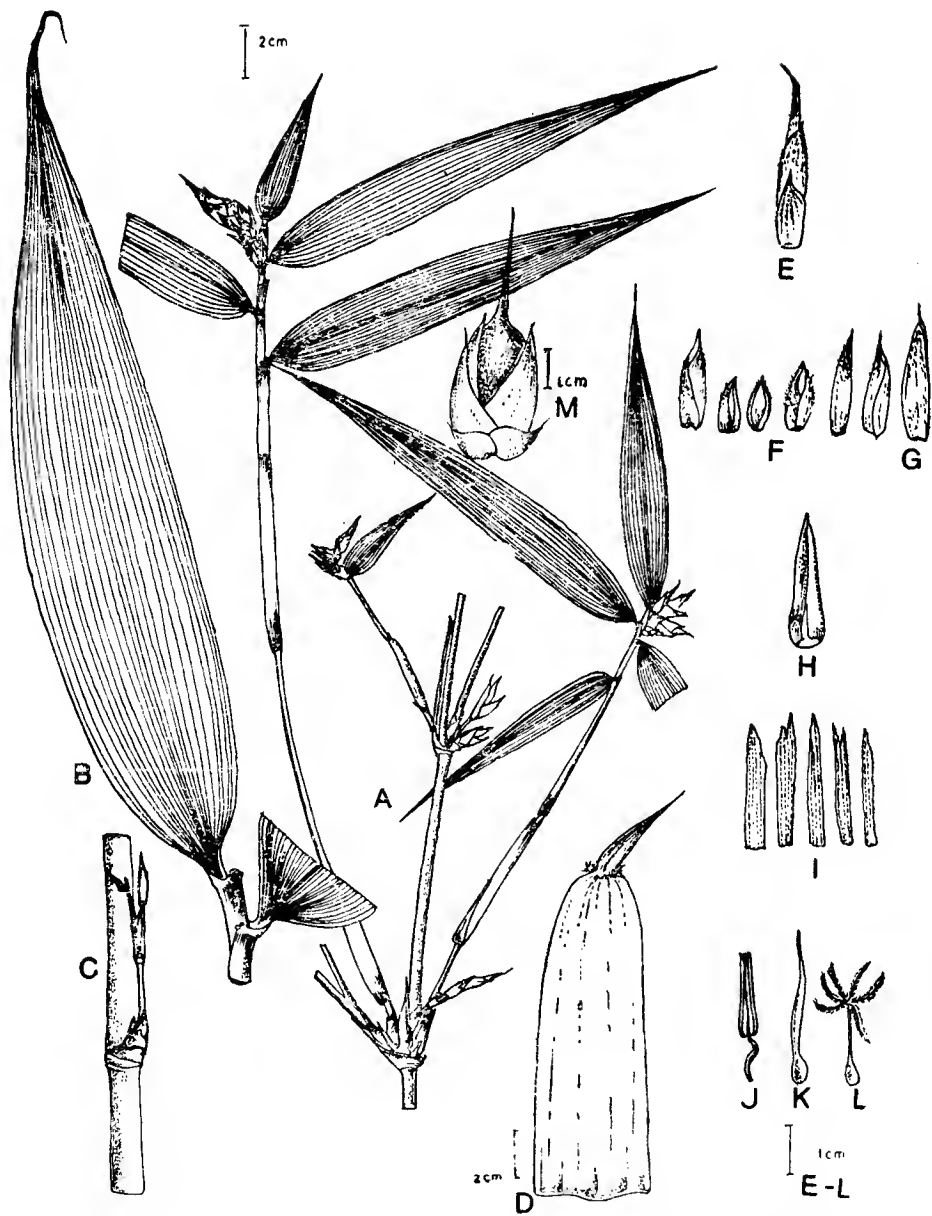


Fig. 1. *O. beddomei*. A. Leafy branch, B. Leaf-sheath, C. Culm shows branching. D. Culm-sheath, E. Spikelet, F. Sterile glumes, G. Fertile glume, H. Palea, I. Lodicules, J. Anther, K. Ovary and style, L. Ovary with stigmas.

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numerous transverse veinlets; sheaths ciliate-auricled, striate, glabrous. Ligule 2–4 mm long. Inflorescence a flagellate spike of verticillate clusters of sessile spikelets with a few comparatively large fertile spikelets mixed with smaller sterile ones. Fertile spikelets 3–3.5 cm long, 5–7 mm broad, cylindro-conical, smooth, shining and glabrous. Sterile glumes 4, 0.6–1.3 cm in flowers, 1.3–1.8 cm in fruits. Fertile glume 1.75 cm long in flowers, 2.5–3 cm in fruits. Palea 1.4 cm long in flowers, 3 cm in fruits. Lodicules 4. Stamens numerous, filaments fused; anthers 10–15 mm long. Ovary very small dorsally compressed, somewhat spherical; stigma 7–9, plumose. Caryopsis  $6 \times 1.5$  cm, light chocolate brown in colour, oblong, with a long awn-like beak.

**Distribution:** Kerala: Parithipally Range, Kottur R. F., Trivandrum. Confined to the hilly districts of Kerala along stream sides, Endemic to Western Ghats.

**Flowering:** First time noted in 1961 and 1963. It flowers gregariously and the clump dies after flowering. Recently collected in flowering during 1987, 1988 and 1992 from Kerala state.

**Uses:** Used in paper pulp industry and for making baskets and mats. Powder prepared from the dried seeds are used for cattle feed.

**Specimens examined:** Kerala: Milepalam, Arippa. *Muktesh Kumar* 6473 (KFRI); Kottavasal - way to Achenkoil. *Jayalakshmi* 6694 (KFRI); Kottavasal-way to Achenkoil. *Joy* 6496 (KFRI); Palapilly subcentre. *Muktesh Kumar* 6761 (KFRI).

*Ochlandra scriptoria* (Dennst.) Fisch. in Gamble, Fl. Pres. Madras 3 (10): 1863. 1934; Varmah & Bahadur, Indian For. Rec. (N. S.) Bot. 6 (1): 3. 1980; Tewari, Monogr. Bamboo, 110. 1992.

*Bambusa scriptoria* Dennst., Schluessel Hort. Malab. 31. 1818.

*Bheesa rheedii* Kunth, Enum. 1: 434.1822.

*Ochlandra rheedii* (Kunth) Benth. & Hook. f. ex Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 121. 1896 & in Hook. f., Fl. Brit. India 7: 418. 1897; Camus, Les Bambusees 181. 1913.

Type: not seen.

Vern.: Ottal, Ammei (Mal.)

(Fig. 3)

A gregarious shrubby bamboo. Culms erect, upto 5 m tall, smooth; nodes somewhat raised. Internodes 25 cm long, 2.5 cm in diam. Culm-sheath truncate with 2, falcate, long-ciliate auricles; blades long, ensiform, 10–15 cm



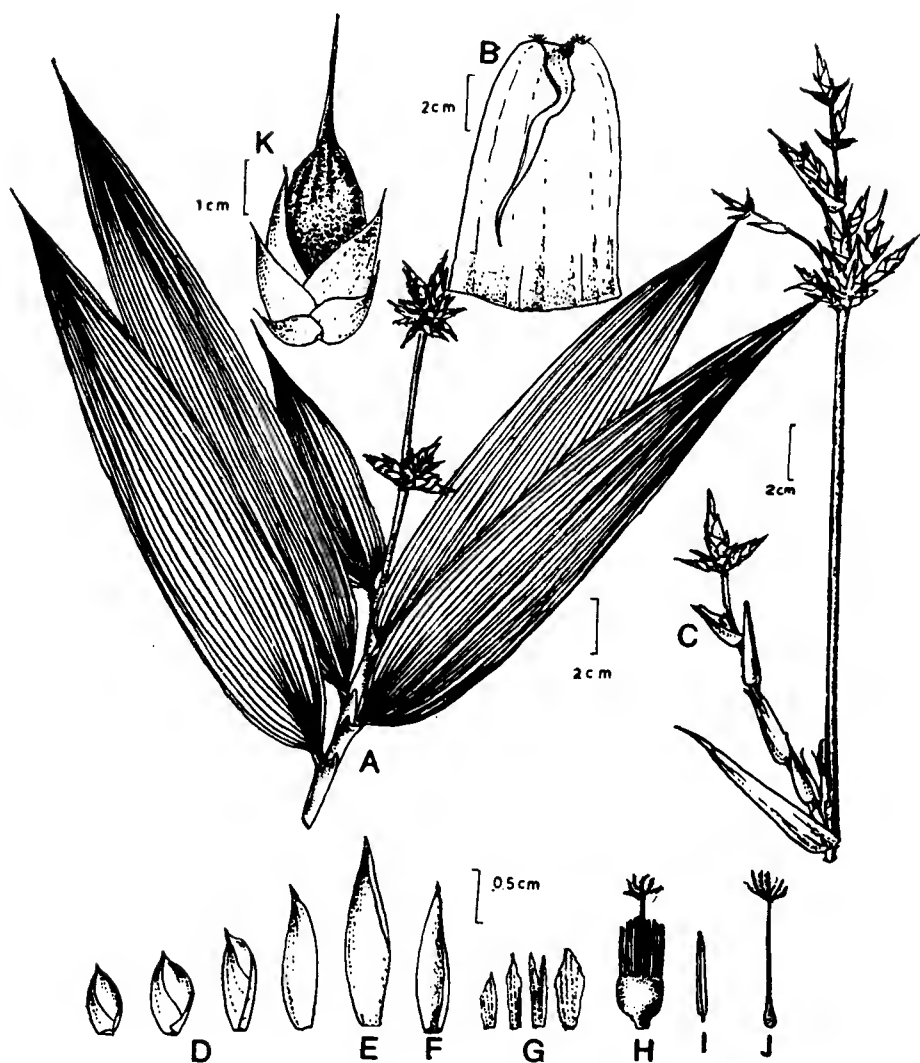
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Fig. 2. *O. ebracteata*. A. Leafy branch, B. Culm-sheath, C. Flowering branch, D. Sterile glumes, E. Fertile glume, F. Palea, G. Lodicules, H. Flower showing stamen, style and stigma, I. Anther, J. Ovary, style and stigma K. Caryopsis.

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long, purplish. Leaves linear lanceolate,  $10-25 \times 1-3$  cm, with larger and smaller ones intermixed, smaller being most frequent, rounded at base, pointed at apex, smooth on both surfaces; sheath smooth, with 2 falcate auricles fringed with deciduous bristles, ligule very short. Inflorescence a short terminal or axillary spike. Spikelets cylindric, acute, glabrous; sterile ones in heads, smaller, 1.2–1.8 cm long; fertile few, subsolitary with bracts. Sterile glumes 1.5–2 cm in flowers, 1.2–2 cm in fruits, many-veined, broadly ovate, acute. Fertile glume large, 2.2 cm in flowers, 4–4.4 cm in fruits, subacute. Palea 2.1 cm in flowers, 4.6 cm in fruits, convolute, not keeled. Lodicules many. Stamens 15–18 or more, exserted; filaments free, slender; anthers mucronate. Ovary oblong, surmounted by perigynium containing the style. Stigmas 3, plumose. Caryopsis  $7.5 \times 1.2$  cm, long beaked.

**Distribution:** Mostly found on river banks and stream sides. Common in Kerala, Karnataka and Tamil Nadu. Endemic to western Ghats.

**Flowering:** Reported to be flowering annually; flowering specimens were collected from Western Ghats during 1988 and 1992.

**Uses:** This is one of the important bamboo species used mainly in pulp/paper industry. Also used for mat, basket, floats and roofings. Bamboo boards are made from mats. Small culms are used for making flutes.

**Specimens examined:** Kerala: Cannanore Dist., Chandanathode. *Ramachandran* 58288 (MH), 66838 (MH), 61396 (MH); Idukki Dist. *Muktesh Kumar* 6458 (KFRI); Locality not known *Mohanar* 74564 (MH). Calicut Dist., Peruvanamuzhi. *Muktesh Kumar* 6417 (KFRI); Palghat Dist. *Muktesh Kumar* 6437 (KFRI).

**Notes:** There is a specimen with Acc. No. 88795 at MH which had been identified as *Bambusa arundinacea*. Fischer has corrected the identity of the specimen as *Ochlandra scriptoria* (Dennst.) Fischer.

***Ochlandra setigera*** Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 128. 1896 & in Hook f., Fl. Brit India 7: 420. 1897; Camus, Les Bambusees 184. 1913; Varmah & Bahadur. Indian For. Rec. (N. S.) Bot. 6 (1): 3. 1980; Tewari, Monogr. Bamboo 113. 1992; Chand Basha & Kumar, Rheede 4(1): 26. 1994.

Type: *Gamble* 20503 (K).

(Fig. 4).

Culms erect, often straggling, 6 m high, without branches at the base, much branched on the upperside; 1.2 to 1.8 cm in diam. Culm-sheath persistent

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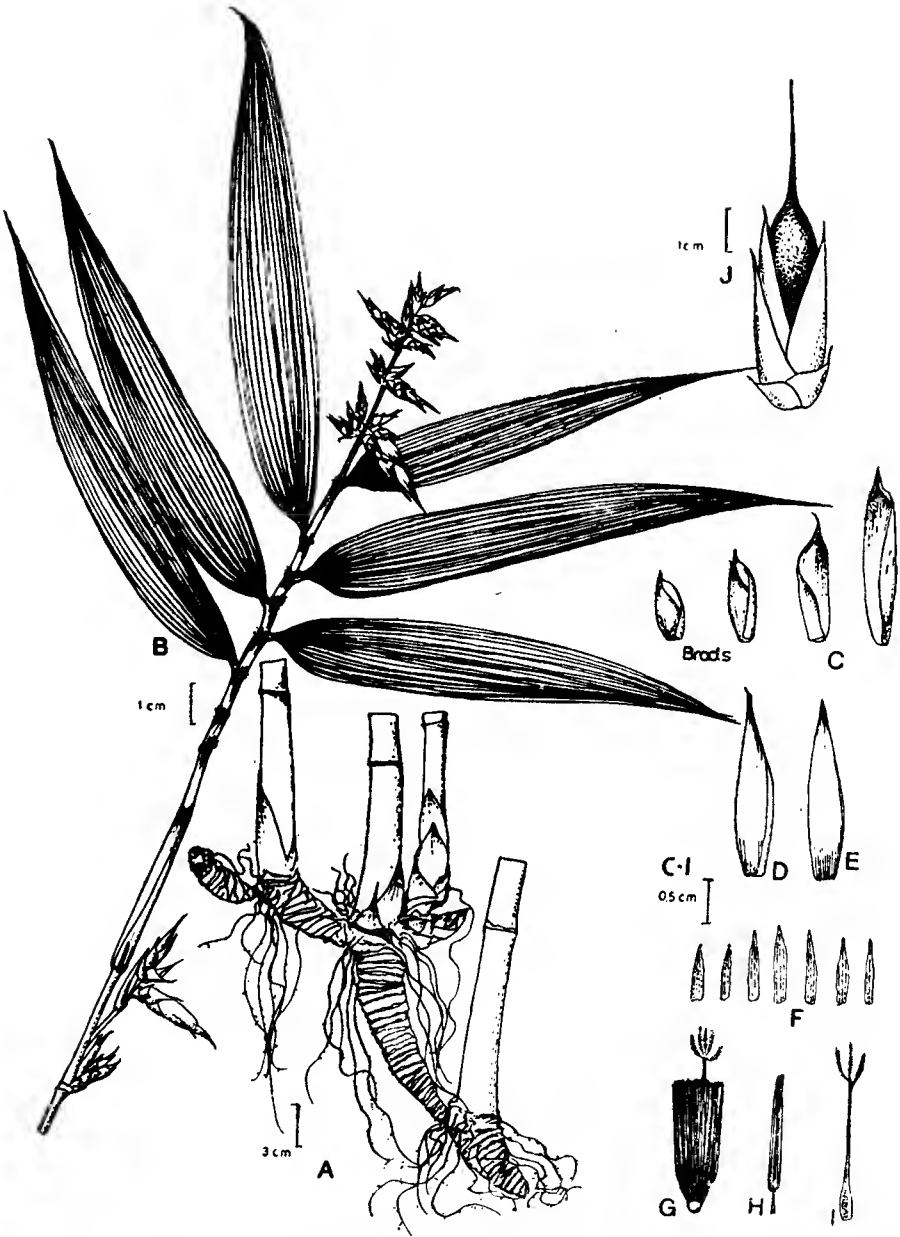


Fig. 3. *O. scriptoria*. A. Rhizome, B. Leaf with flowering branch, C. Sterile glumes, D. Fertile glume, E. Palea, F. Lodicules, G. Flower shows stamen, style and stigma, H. Anther, I. Ovary, style and stigma, J. Caryopsis.

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15—19 cm long, thin papery, striate, wrinkled near the top, gradually attenuate to a narrow apex, 1.1—2 cm long, subulate, hair like, edges incurved and hairy within; ligule very narrow, short. Leaves oblong-lanceolate, acuminate 12—26 × 1.8—3 cm, rounded at the base, smooth above, minutely hairy beneath, scabrous on margins, tip twisted and hair like; midrib narrow, secondary veins 5—7 pairs, intermediate 6—7, pellucid-glandular; petiole 3—6 mm long; sheath smooth with short decurrent auricles, fringed with long stiff curved bristles. Inflorescence a short axillary or terminal spike on leafy branchlets. Sterile spikelets in heads, smaller than the fertile, cylindric, tip pointed, clothed with white hairs, rachis smooth. Fertile spikelets 1.8—2.2 cm long. Sterile glumes 3, hairy, 0.7—1.3 cm long in flowers, 1—1.8 cm in fruits, many-nerved, ovate-acute, mucronate. Fertile glume larger, glabrous, acute at apex, 2.4 cm in flowers, 2.4—3.5 cm in fruits. Palea 2.5 cm long in flowers, 3.8 cm in fruits, lemma membranous, many-nerved, acute at the tip. Lodicules 5, 1.3—1.4 cm long, 3—6-nerved, 3 of them bifid. Stamens many, ca. 26—32, exserted, filaments free, short; anthers surmounted by perigynium. Stigmas 5, plumose, 3 larger and 2 shorter. Caryopsis oblong, 6.8 × 1.3 cm, fleshy.

**Distribution:** Restricted in distribution. Found in Kerala (Nilambur), Tamil Nadu (Nilgiris) at an elevation of 1000 m and above. Endemic to Western Ghats.

**Flowering:** Flowering reported from Nilambur in 1988 for the first time and again found in flower during 1994.

**Uses:** Local people use this for tying bundles of fire-wood; and for basket making. Leaves are used as fodder.

**Specimens examined:** Tamil Nadu: Nilgiri Dist., Gudalur. *Gamble* 20503 (K, Photograph-Cibachrome); Kerala: Moolapadam, Choondayil-Nilambur. *Muktesh Kumar* 6613 (KFRI).

***Ochlandra sivagiriana* (Gamble) Camus, Les Bambusees 181. 1913; Varmah & Bahadur, Indian For. Rec. (N. S.) Bot. 6 (1): 3. 1980; Tewari, Monogr. Bamboo. 113. 1992.**

***O. Rheedii* var. *sivagiriana* Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 122. 1896.**

**Type:** *Gamble* s. n. (K).

(Fig. 5)

Small straggling bamboo. Culms upto 5 m high; nodes somewhat raised; internodes 36 cm long, 1.8 cm diam. Culm-sheaths 18 cm long, striate when old. Leaves linear-lanceolate, acuminate at tip, 8—22 × 1—2.5 cm, attenuate at base. Petiole 2—4 mm long. Midrib narrow, secondary

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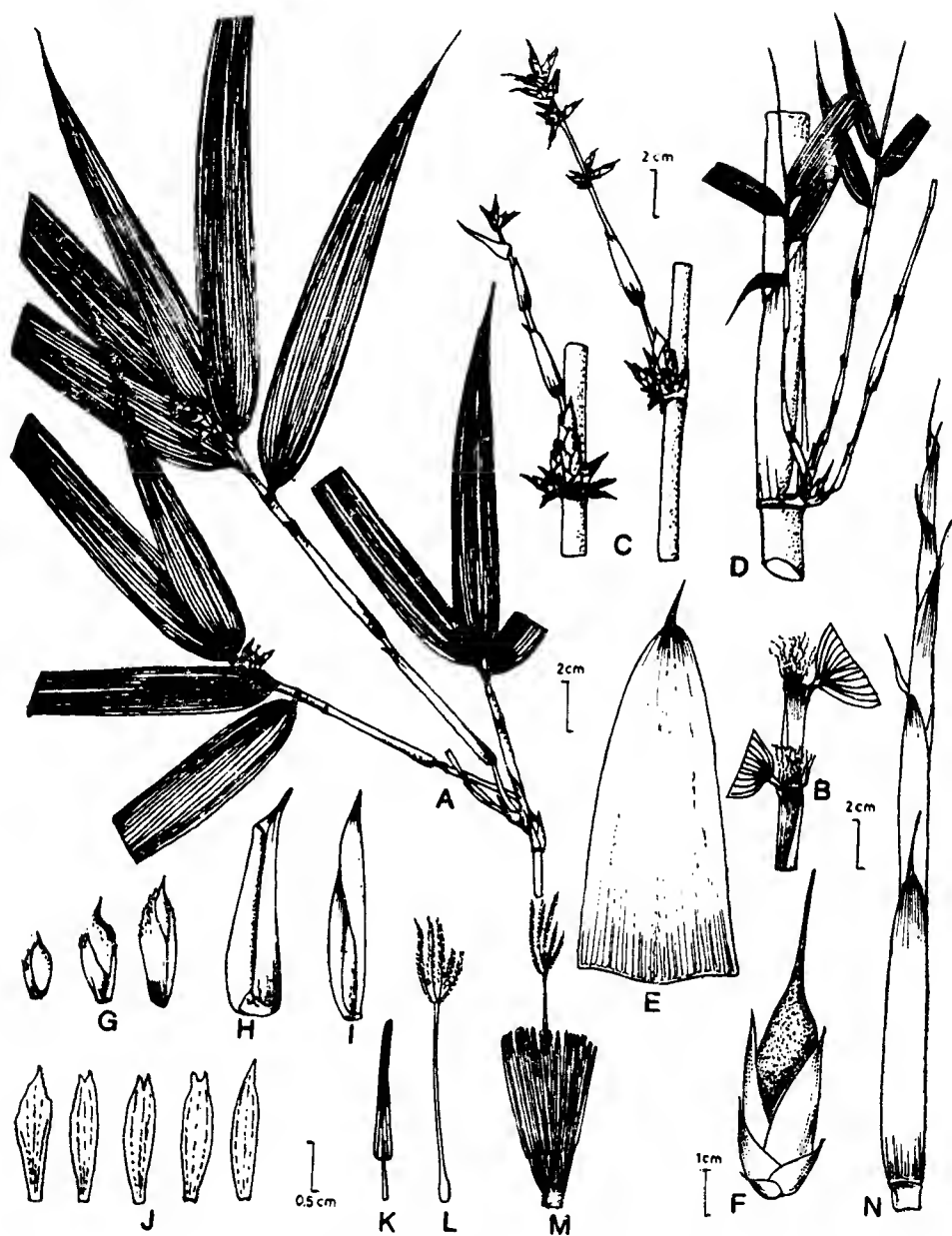


Fig. 4. *O. setigera*. A. Leaf with Flowering branch, B. Leaf-sheath, C. Flowering branch, D. Culm shows branching, E. Culm-sheath, F. Caryopsis, G. Sterile glumes, H. Fertile glume, I. Palea, J. Lodicules, K. Anther, L. Ovary, style and stigma, M. Flower showing anther style and stigma, N. Young shoot.

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veins 7—10 pairs; sheath smooth, glabrous, with two falcate auricles, fringed with deciduous bristles; ligule very short. Inflorescence terminal or axillary or spicate panicles on leafy branchlets. Spikelets cylindric, acute, slightly hairy,  $4 \times 0.5$  cm, fertile few. Sterile glumes 2, 1.6—2.2 cm in flowers, many-nerved, acuminate at the tip. Fertile glumes larger, 3.2 cm long, many-veined. Palea 3.2 cm long, convolute, mucronate, membranaceous. Lodicules 6, 1.5 cm long, 1—5-nerved. Stamens 27 to 32, exserted, filaments free, anthers slightly apiculate. Ovary oblong, surmounted by perigynium containing the style; stigma 5, plumose. Caryopsis not known.

**Distribution:** Very restricted in distribution. Found only in Sivagiri and Palni Hills (Tamil Nadu), and Vazhachal (Kerala). Endemic to Western Ghats.

**Flowering:** Flowering reported for the first time in clump naturally occurring at Vazhachal (Kerala) in 1993. After flowering the clump died. Fruits not observed.

**Uses:** Used for making basket and tying bundles. Culms are used by tribal people for fencing.

**Specimens examined:** Kerala: Vazhachal, Trichur Dist. *Muktesh Kumar* 6735 (KFRI); Tamil Nadu: Sivagiri. *Gamble* Acc. 887796 (MH).

**Note:** The type specimen at Kew is extremely poor and has only a few spikelets and some hand drawings of floral dissection by Gamble himself. At MH, there is one specimen (Acc. No. 88796) from Sivagiri Hills, on which Gamble himself has annotated as "I think I was wrong in making this a variety only. I suspect it is a true species".

***Ochlandra stridula*** Moon ex Thwaites, Enum. Pl. Zeyl. 376. 1864; Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 123. 1896; Soderstrom & Ellis, Smithsonian Contrib. Bot. 72: 67. 1988.

***Beesha stridula*** (Moon ex Thw.) Munro, Trans. Linn. Soc. London 26: 145. 1868.

***Ochlandra stridula* var. *maculata*** Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 124. 1896.

Type: Ceylon, C. P. 241 (lectotype, PDA, K. Photograph-Cibachrome-seen)

(Fig. 6)

Plants not caespitose. Rhizome pachymorph with a short neck, producing a dense clump with closely placed culms. Culm soft, dark green, self-supporting below and slightly arched above, 4—5 m tall with about 16 nodes;

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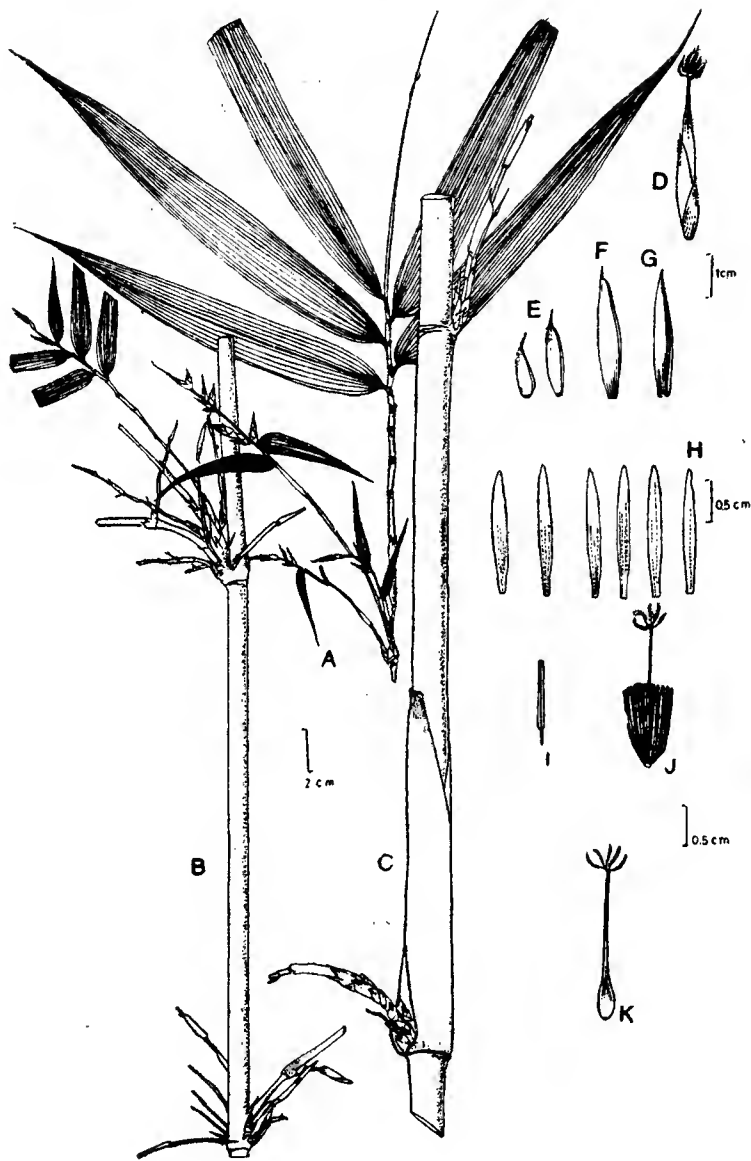


Fig. 5. *O. Sivagiriensis*. A. Leafy branch, B. Culm shows branching. C. Culm with Culm-sheath, D. Spikelet, E. Sterile glumes. F. Fertile glume, G. Palea, H. Lodicules, I. Anther, J. Flower with anther, style and stigma. K. Ovary, style and stigma.

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branching starts from above the 7th node. Each node with a dormant prophyllate bud; internodes cylindrical, hollow, those of the mid culm 39—42 cm long. Culm-sheaths 7.5 cm long, 1 cm wide, laminiferous with a lateral extension of 25 mm width from either side, about  $\frac{1}{3}$  below the attenuate apex; upper surface green, glabrous except for the whitish short hirsute base, the sheath with auricles on either side of the insertion of the blade bearing antrorsely barbed oral setae, the ligule membranaceous with entire margin. Leaves lanceolate, acuminate at the tip, 23—34 cm long, 2.5—5 cm wide, glabrous, leaf base narrow at the base. Petiole 4 mm long, at length abscissile at the level of insertion of the petiole on the sheath; inner ligule a hard stramineous rim with a ciliate margin; outer ligule similar but shorter; auricles with oral setae; leaf sheath thick, hard, stramineous, glabrous. Inflorescence as pseudospikelets, forming aggregations terminal to leafy axis, all branches at successive nodes of the main culm; flowering or occasionally single leafy branch flowering. Spikelets ovate-lanceolate, 3 cm long, 5 mm wide, with 3 transitional glumes, lemma 1, palea 1, lodicules 7, stamens 27 and pistil 1; transitional glumes firm, ovate, 10—15 mm long with a mucro, 2—2.5 mm long, many-nerved, glabrous except for a few appressed hairs on the upper third, the margins overlapping, ciliate along the overtopping edge; lemma membranaceous, about as long as the palea with margins overlapping, glabrous, 18-nerved with a slight sulcus in the middle, without transverse veinlets; lodicules in 2 alternating whorls, membranaceous throughout, lanceolate, 3—5-nerved, 10—12 mm long, 1.9—2.5 mm wide; stamens yellow (brown with green tips, when mature), with 1 or 2 spicules at the apex of the connective, the filaments filiform, free, basifixed, the anthers opening by an apical pore. Ovary glabrous, rounded at the base becoming quadrangular above, with a glabrous quadrangular perigynium enclosing a style, the whorl fused at the base and apex, but free for the greater part of the length, the perigynium with a prominent nerve on each corner, dividing terminally into 3 stigmas (one of which branched at its base to produce a fourth one). Caryopsis not known.

**Distribution :** Grows extensively in dense thickets in the rain forests of the wet lowland and lower montane areas. In forest gaps and stream sides at Sri Lanka. Endemic to Sri Lanka.

**Flowering :** No recent flowering is reported.

**Uses :** Used mainly for production of basket ware, storage boxes for paddy, winnowing fans, housing, culm for wattle, culm strips for woven inner partitions; and also for flute making and leaves for roof thatch.

**Specimens examined:** There are 4 specimens in Munro Herbarium, Kew. One of the specimens marked C. P. 241 has been chosen as lectotype; Sri Lanka;



Taxonomy of the genus *Ochlandra* Thw.

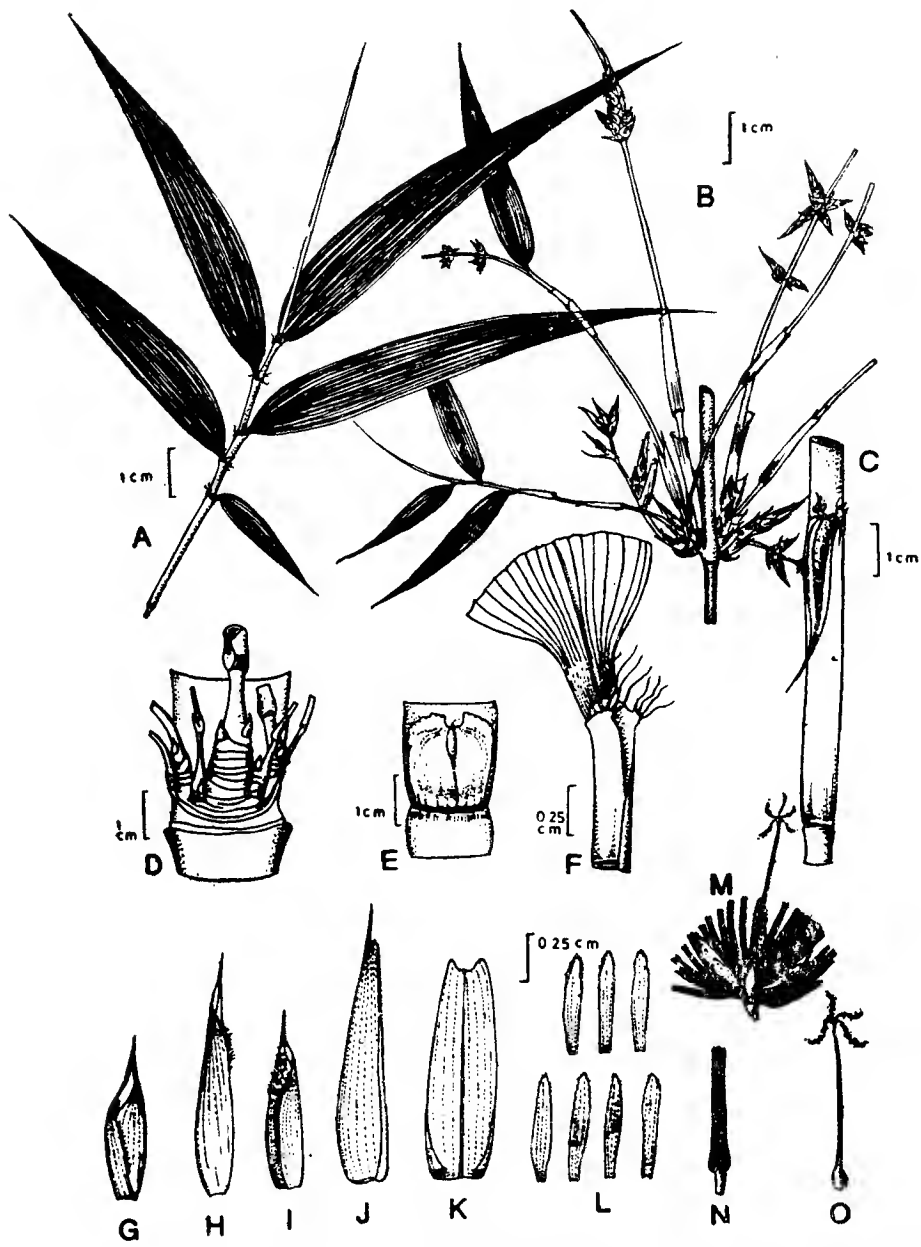


Fig. 6. *O. stridula*. A. Leafy branch, B. Flowering branches, C. Culm-sheath in place, D. Branch complement, E. Young culm bud, F. Leaf ligule, G. 1st transitional glume, H. 2nd transitional glume, I. 3rd transitional glume, J. Lemma, K. Palea, L. Lodicules, M. Flower, N. Stamen, O. Pistil.

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*S. coll.* C. P. 241, O. C. 1044 (PDA, K); *Thwaites* 62088 (MH). Thwaites himself has annotated as "In Ceylon it is called 'Batta' often cultivated (= *Bheesha stridula*)".

The description and illustrations in this paper have been mainly adopted from Soderstrom and Ellis (1988).

***Ochlandra talboti*** Brandis, Indian Trees 684. 1906; Camus, Les Bambusees 181. 1913; Varmah & Bahadur, Indian For. Rec. (N. S.) Bot. 6 (1): 3. 1980; Tewari, Monogr. Bamboo 115. 1992.

*O. rheedi* var. *sivagiriana* sensu Talbot, Trees of Bombay 348. 1902, non Gamble, 1896.

*O. stridula* Woodr., J. Bombay Nat. Hist. Soc. 13: 442. 1901.

Type: not seen.

(Fig. 7)

Erect, arborescent bamboo, growing in dense clumps. Culms 3 to 6 m high, 1.2–1.8 cm diam., slender and arching at the tip. Culm-sheath smooth, striate, ciliate on the margins, rounded with two small ciliate auricles at the top; blade subulate, acuminate, hairy within at the base; ligule short. Internodes about 40 cm long, 2.5 cm diam. Leaves lanceolate, 20–26 × 3–3.5 cm, ending in a long setaceous point at the apex, cordate or subacute at the base, pale green beneath; midrib prominent, secondary veins 10 pairs, intermediate about 8, distinct; petiole short, broad and grooved above; sheath smooth, striate, truncate at the top, bearded with long stiff bristles. Inflorescence terminal or axillary spike, 10–20 cm long. Spikelets 2–6, 0.6–3.2 cm long, in half whorls which are 2.5 cm apart at the base and congested at the top of rachis; fertile spikelets ovoid, cylindric, few, 2.5–3.2 cm long. Sterile glumes 3–4, 0.7–1.3 cm in flowers, 0.8–1.2 cm in fruits, broadly-ovate, acute, spinous-mucronate with spreading white hairs at the tip; fertile glume larger, 1.6 cm long in flowers, 2–2.2 cm in fruits, acute; palea 1.8 cm in flowers, 3 cm in fruits; lodicules 6–7, linear. Stamens 26–40, exserted and pendulous; filaments long, slender; anthers linear, sagittate at base. Ovary with 2 cm long style, slender; stigma 5, plumose. Caryopsis ovoid, 6 × 1 cm, glabrous, supported by the persistent glumes and with a curved beak. Pericarp thick and fleshy.

**Distribution.** Grows in rain forests often along stream banks on the Southern Ghats, Karnataka (Coorg and North Canara) and Virajpet. Endemic to Western Ghats.

**Flowering:** Throughout North Canara it flowered in 1896. Recently flowering was observed in Virajpet during 1994.

Taxonomy of the genus *Ochlandra* Thw.

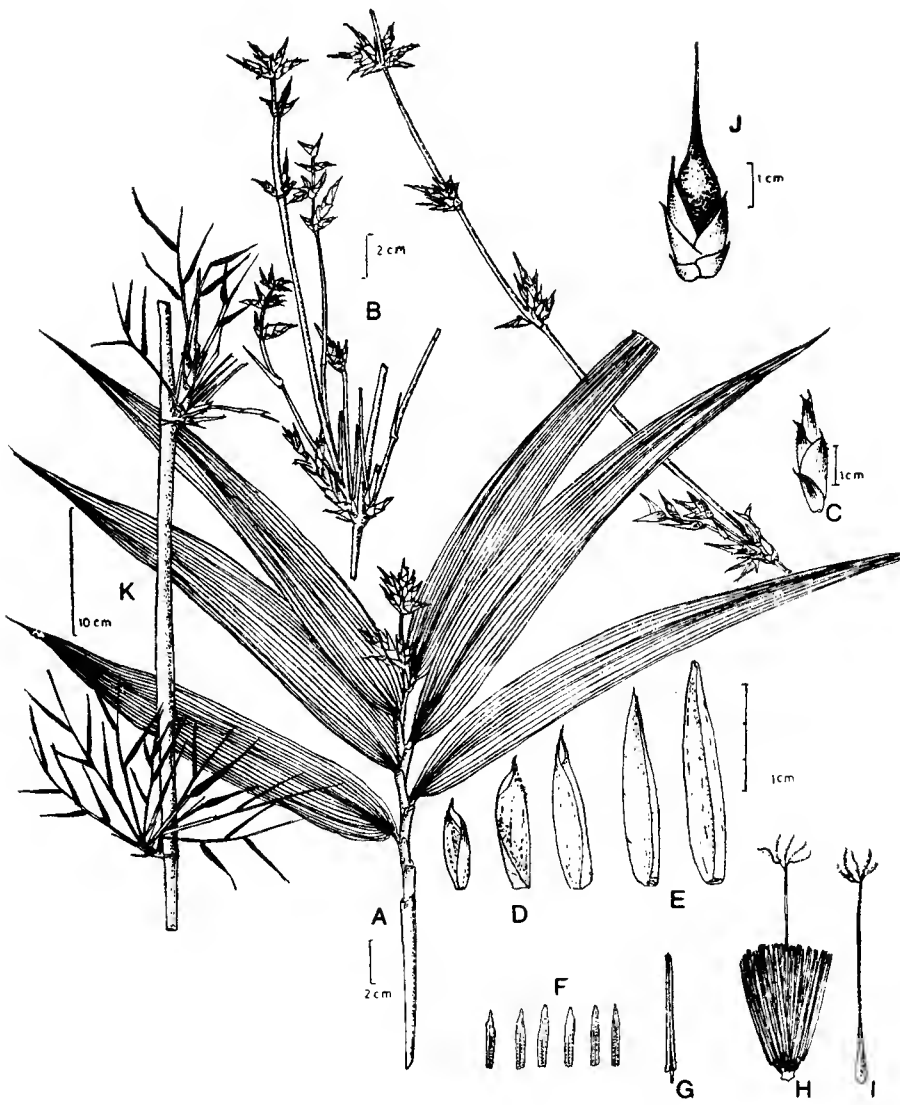


Fig. 7. *O. talboti*. A. Leafy branch with Flower, B. Flowering branch, C. spikelet, D. Sterile glumes, E. Fertile glume and Palea, F. Lodicules, G. Anther H. Flower with style and stigma, I. Ovary, style and stigma, J. Caryopsis, K. Culm shows branching.

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*Uses:* Used for mat and basket making.

*Specimen examined:* Karnataka: Makutta (Virajpet). *Muktesh Kumar* 7533 (KFIR).

***Ochlandra travancorica*** Benth. in Benth & Hook. f., Gen. Pl. 3: 1215. 1883; Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 125, pl. 111. 1898 & in Hook. f., Fl. Brit. India 7: 419. 1897; Camus, Les Bambusees 182. 1913; Varmah & Bahadur, Ind. For. Rec. (N.S.) Bot. 6 (1): 4. 1980; Tewari, Monogr. Bamboo 115. 1992.

var. ***travancorica***

*Bheesha travancorica* Bedd., Fl. Syl. 239, pl. 324. 1873.

Type: *Beddome* s.n. (K).

Vern. Etta, Kar-eetta, Vei (Mal.); Eeral, Eerakalli, Iral, Irul, Ita-kalli, Nanal, Odai (Tam.).

(Fig. 8)

Erect, shrubby, arborescent, reed-like, gregarious bamboo. Culms 2—6 m tall, greyish-green, rough, 2.5—5 cm in diam.; nodes somewhat swollen and marked with base of fallen sheaths; internodes usually 45—60 cm long, sometimes even 1.5 m long, walls very thin, 2.5 mm. Culm-sheaths 15—20 cm long, thin, longitudinally wrinkled, striate, covered densely with appressed golden or black bulbous based hairs when young, glabrous afterwards, truncately rounded above and with a fringe of erect stiff bristles, ciliate on the margins; blade narrow, subulate, 4—8 cm long; ligule narrow, entire. Leaves broadly oblong-lanceolate, 9—30 × 5—12 cm; often obliquely rounded at the base into a thick, broad, somewhat concave, 0.7—1 cm long petiole, apex long, setaceous, often twisted; both surfaces glabrous or slightly rough, edges scabrous, midrib prominent at the basal portion tapering upwards; secondary veins 12—17 pairs; intermediate 6—8; regular transverse veinlets none, but pellucid glands present; sheath striate, glabrous, keeled, ciliate in the edges, ending in a smooth callus and short, falcate auricles; mouth furnished with several. upto 2.5 cm long bristles; ligule short, truncate. Inflorescence a sub-verticillate, spicate panicle, with a few, large fertile spikelets and a few much smaller sterile spikelets in the axils of ovate-lanceolate, smooth, bracts which bear deciduous imperfect blades. Spikelets ovate or oblong-ovate, 3—4 × 0.8—1 cm, glabrous, striate, supported by 2—4 small sheathing bracts. Sterile glumes usually 3, 1.2—2.4 cm in flowers, 1.8—2.5 cm in fruits, concave, ovate, truncate at the top and tipped with a subulate apex, many-veined and faintly transversely veined. Fertile 3.1 cm in flowers, 3—4 cm in fruits. Palea 2.4 cm long in flowers, 3.8 cm in fruits, shorter, thinner, acute; lodicules 3, unequal,

Taxonomy of the genus *Ochlandra* Thw.

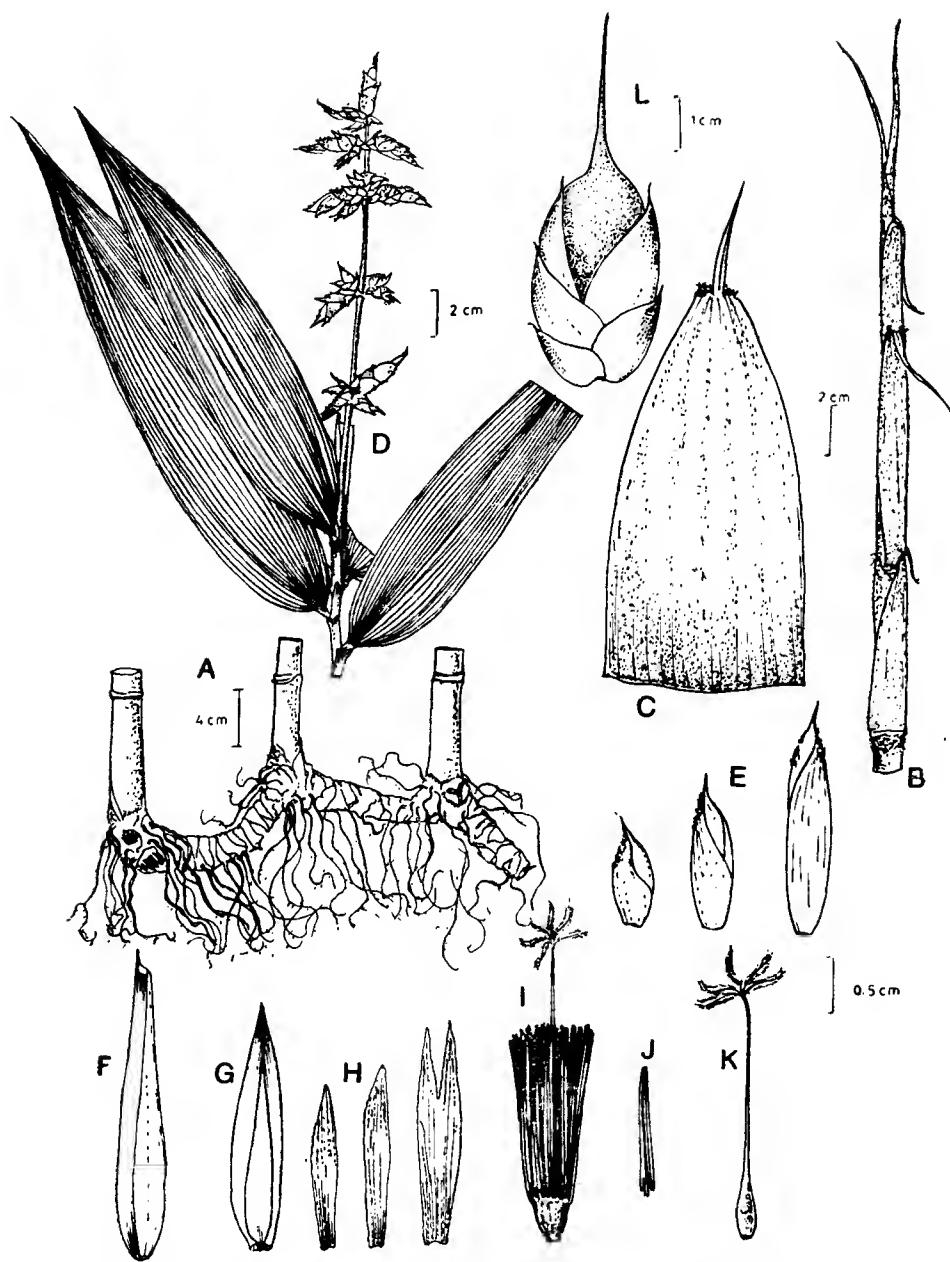


Fig. 8. *O. travancorica*. A. Rizhome, B. Young shoot, C. Culm sheath, D. Leafy with Flowering branch, E. Sterile glume, F. Fertile glume, G. Palea, H. Lodicules, I. Flower with stamens, style and stigma, J. Anther, K. Ovary, style and stigma, L. Caryopsis,

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membranaceous, 1.6—2.2 cm long, 3—7 nerved, one 2-cleft. Stamens upto 120, monadelphous, at first included and afterwards long exserted; filaments slender; anthers *ca.* 2.5 cm long, narrow, long, hairy, apiculate. Ovary narrow, smooth, surmounted by tri- or quadrangular perigynium enclosing the style; stigma 5—6, plumose, spirally twisted together. Caryopsis large,  $7.5 \times 2.4$  cm, brown, oval-oblong, pericarp wrinkled fleshy.

*Distribution:* This species is distributed throughout the Western Ghats and occur widely as an undergrowth in the lowland evergreen and semi-evergreen forests. Pure patches grow as impenetrable thickets along the sides of rivers and streams. More abundant in southern Kerala. Endemic to Western Ghats.

*Flowering:* Gamble reports the flowering cycle of the species as 7 years. Gregarious flowering was reported in 1868, 1875, 1882, 1905 and more recently in 1976, 1988, 1992 and 1993.

*Uses:* An ideal raw material for paper manufacture. Culms are used for mat and basket making, housing. Mats are used for making 'bamboo ply'.

*Specimen examined:* Kerala: Mancheri, Nilambur, *Muktesh Kumar* 6416 (KFRI); Nelliampathi, Kaikatty, *Muktesh Kumar* 6422 (KFRI); Plapilly, Amgumuzhi Road, Ranni, *Muktesh Kumar* 6429 (KFRI); Poopara section, Karimala Range, Parambikulam, *Muktesh Kumar*, 6438 (KFRI), Choclanode estate south, *Muktesh Kumar* 6440 (KFRI); Viripara - Mankulam Road, one kilometer away from KFDC, *Muktesh Kumar* 6442 (KFRI); Neriamangalam-Munnar Road, *Muktesh Kumar* 6446 (KFRI); Edamalayar, from dam site, *Muktesh Kumar* 6457 (KFRI); Pooyamkutty, Pindimedu, *Muktesh Kumar* 6459 (KFRI), Trivandram Dist.,- *Mohanan* 61719 (MH), Bonnacord; Palghat Dist.,- *Nair & Bhargavan* 69760 (MH), Silent Valley; Cannanore Dist.,- *Ramachandran* 58287 (MH), Kannothe RF; *Ramachandran* 66838 (MH), Chandanathode; Pathanamthitta Dist.,- *Anilkumar* 1131 (MH), from lower Moozhiyar at an alt. 1250 m; Idukki Dist.,- *Pandurangan* 79243 (MH), Vallakadu, Pooyamkutty; Tamil Nadu: Kanyakumari Dist.,- *Henry* 49415 (MH), Muthukuzhyvayal; *Narayanaswami* 5328 (MH) from Karian Sholai, Top slip at 2300 m alt.

*Note:* The type specimen in Gamble's Herbarium at Kew, "taken from the sheet in the Madras Central Museum Herbarium by kind permission of the Curator.....", has a culm sheath, and some flowering material with two sets of fruits. The one with persistent glumes "received from J. W. Bourdillon" and the other "from F. School-Museum"- (see Gamble's annotation on the sheet).

Taxonomy of the genus *Ochlandra* Thw.

***Ochlandra travancorica* Benth. var. *hirsuta* Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 126. 1896; Camus, Les Bambusees 183. 1913; Varmah & Bahadur, Ind. For. Rec. (N. S.) Bot. 6 (1): 4. 1980; Tewari, Monogr. Bamboo, 117. 1992; Chand Basha & Kumar, Rheedea 4 (1): 28. 1994.**

Type: *Beddome* 87 (K), Cibachrome seen.

(Fig.9)

Culms 2–6 m tall, 2–2.5 cm in diam., grey-green; nodes swollen, internodes very long. Culm-sheaths truncate with a long subulate blade (4 cm long) at tip and fringed by erect, stiff bristles at the mouth, surface covered with appressed, black or golden, bulbous based hairs. Leaves petioled; petiole 4–8 mm long; lamina 9–32 × 5–6 cm, lanceolate with a setaceous, often twisted tip, rounded at base, pellucid glandular; secondary nerves 7–10 pairs with 6–8 intermediates; leaf sheath falcately auricled at base and with a smooth, callose tip, appressed bulbous-based hairy; ligule short, truncate. Inflorescence of axillary or terminal spicate panicles. Spikelets in verticels, 6 × 1 cm, some small and sterile, others larger and fertile, densely clothed with velvety hairs. Sterile glumes 3, 2–4.5 cm in flowers, 3–4 cm long in fruits, broadly ovate-aristate, margins inrolled. Fertile glume 4.5 cm long in flowers, 6–6.5 cm in fruits, oblong with a ciliate tip, margins inrolled. Palea similar to fertile glume, 4.5 cm long, 6.5 cm in fruits, faintly keeled on the back. Lodicules 3, dissimilar, membranaceous, 2.6–2.9 cm long, linear or lanceolate, acute or forked at tip. Stamens numerous (upto 120); filaments connate below into a tube, free above, anthers linear-apiculate. Ovary ovoid; perigynium 3–4 angled; style linear. stigma 5, plumose. Caryopsis very large, oval-oblong, abruptly beaked at apex, 12 × 3.5 cm; pericarp fleshy.

**Distribution:** Endemic to Kerala region of Western Ghats mainly in Thenmalai, Ranni, Konni and Trivandrum forest division.

**Flowering:** Flowering specimens were collected for the first time during 1992 and 1993. Sporadic flowering was observed, fruits were collected after 4 months of flowering.

**Uses:** Used mainly for pulp and rayon manufacture.

**Specimens examined:** Kerala: Kollathirumedu, *Muktesh Kumar* 6412 (KFRI); Agastyarmalai, *Joy* 6481 (KFRI); Achankoil, Thenmala, *Vijayakumaran & Jayalakshmi* 7214 (KFRI); Pandimotta, Kulathupuzha *Seethalakshmi & Jayalakshmi* 7215 (KFRI); Pongamala, Kulathupuzha *Muktesh Kumar* 7216 (KFRI).

**Note:** There are two sheets of *Beddome's* collection by from "Travancore Hills- 1500–1600 ft", collected during May, 1869. The one in the Munro Herbarium, is extremely poor, while the other has flowering and fruiting material.

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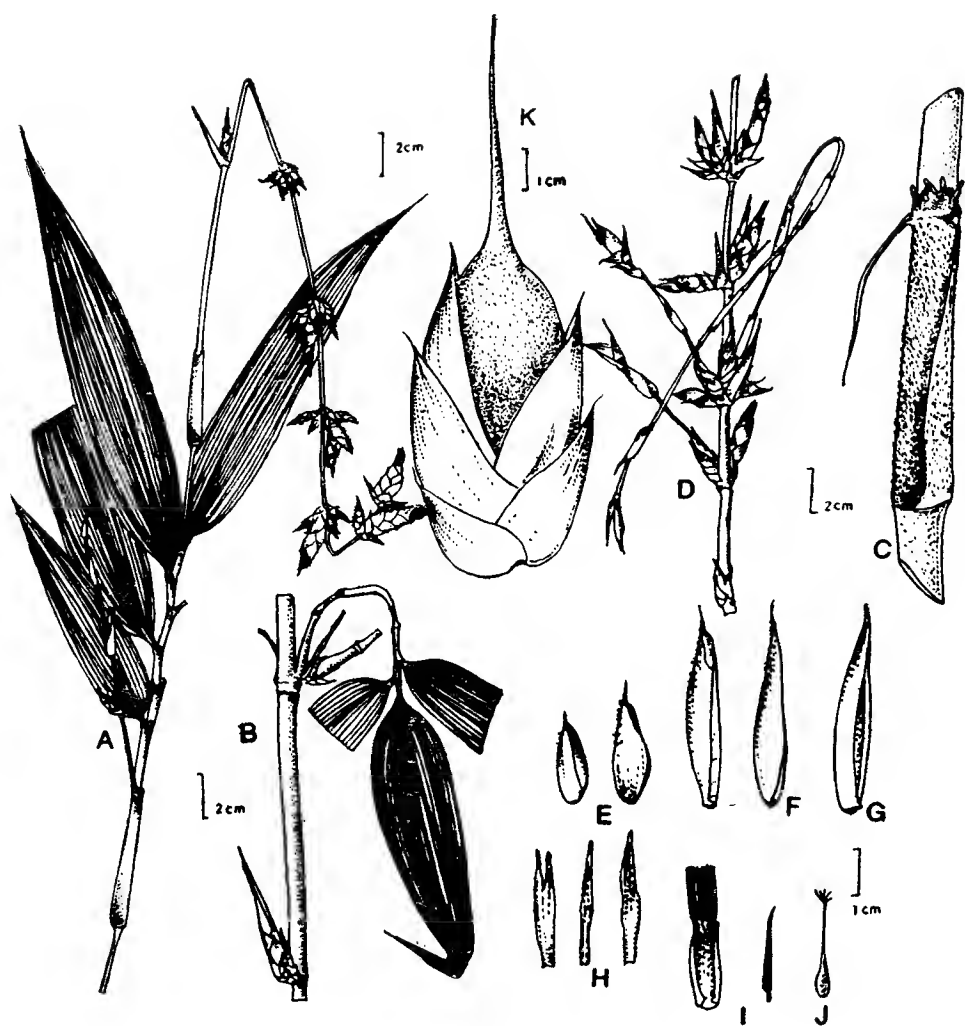


Fig. 9. *O. travancorica* var. *hirsuta*. A. Leaf with flowering branch, B. Leafy branch, C. Culm-sheath, D. Flowering branch, E. Sterile glumes, F. Fertile glume, G. Palea, H. Lodicules, I. Staminal tube, and anthers, J. Ovary, style and stigma, K. Caryopsis.



Taxonomy of the genus *Ochlandra* Thw.

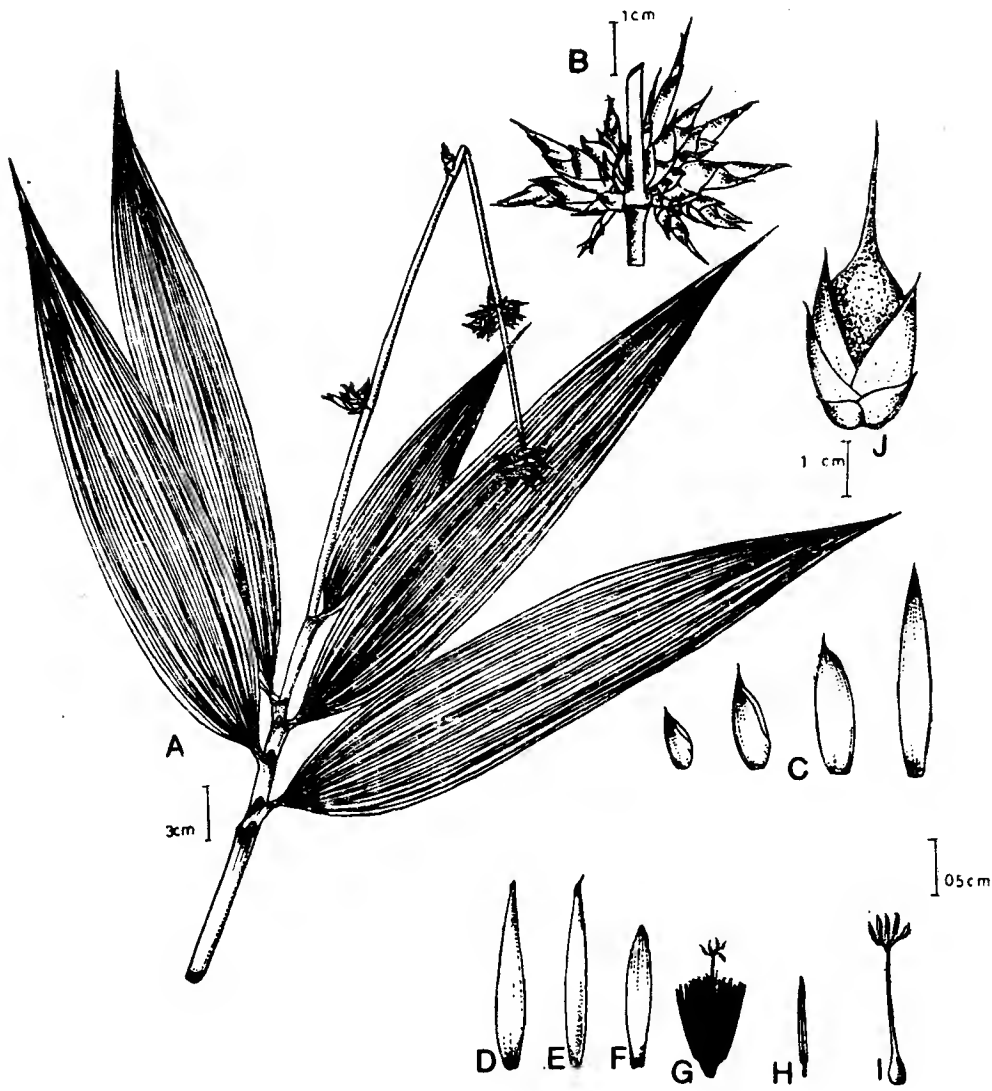


Fig. 10. *O. wightii*. A. Leaf with Flowering branch, B. Spikelets, C. Sterile glumes, D. Fertile glume, E. Palea, F. Lodicule, G. Stamens with style and stigma, H. Anther, I. Ovary, style and stigma, J. Caryopsis.

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**Ochlandra wightii** Fischer in Gamble, Fl. Pres. Madras 1864. 1934; Varmah & Bahadur, Ind. For. Rec. (N. S.) Bot. 6 (1): 4. 1980; Tewari, Monogr. Bamboos 117. 1992.

*O. brandisii* Gamble, Ann. Roy. Bot. Gard. Calcutta 7: 126. 1896 & in Hook. f. Fl. Brit. India 7: 419. 1897; Camus, Les Bambusees 182. 1913.

Type: *Gamble* s. n. (K), Cibachrome seen

Vern.: Ira-kalli (Tam.)

(Fig. 10)

An erect shrubby bamboo, much resembling *O. ebracteata*, each clump comprising about 30–50 culms. Culms upto 6.5 to 7.5 m tall, 1.5–2 cm diam., nodes prominent with greyish bands on both sides, average internode length 48 cm. Culm-sheath 8–15 cm long excluding the blade, 5 cm broad, covered with appressed, light brown subulate hairs; blade 6 cm long, 1–1.5 cm broad, lanceolate, acuminate. Leaves oblong-lanceolate, acuminate, 18–36×3.5–7.5 cm, attenuate at the base, glabrous on both surfaces, whitish beneath, margins cartilaginous, smooth, mid-vein prominent; secondary veins 10–14 pairs; sheath Striate ending in a smooth rounded callus with two short auricles and a few stiff deciduous bristles. Ligule very long. Inflorescence a terminal spike with thick rachis. Spikelets several in the verticels in the axils of bracts, glabrous; 2.3–2.8×0.4–0.6 cm conical steriate. Sterile glumes 4, basal, 0.6–2 cm long in flowers, 0.9–1.5 cm in fruits, outer two thicker and ovate-truncate with a subulate point; the inner two ovate-acute, mucronate. Fertile glume thin, membranous, 1.8 cm long in flowers, 2.5–3 cm in fruits, many veined. Palea 1.8 cm long in flowers, 3.5 cm long in fruits, narrow. Lodicule 1, large, 1.3 cm long, many nerved, tip serrate. Stamens upto 60; filaments narrow, long, apiculate. Ovary glabrous, perigynium thickened and enclosing the style; stigmas 5, plumose. Caryopsis 5.5×1.8 cm, fleshy.

**Distribution:** Restricted to Tamil Nadu and Kerala upto an altitude of 3500 ft.

**Flowering:** Earlier reported flowering in 1835 and 1882. It was recently collected in flowers in 1992 from Achenkoil (Kerala).

**Uses:** Used for basket and mat making found suitable for pulp. The culms are used for making huts and leaves are used as fodder.

**Specimens examined:** Kerala: Uppupara, Muktesh Kumar 6475 (KFRI); Chazhikodu-Kulathupuzha, Trivandrum, Joy 6497 (KFRI); Achenkoil, Seethalakshmi 6707 (KFRI). Nair & Bhargavan 81230 (MH) Nedumgayam; Deb 30386 (MH) Pamba (Kottayam); Vivekananthan 46586 (MH).

Taxonomy of the genus *Ochlandra* Thw.

**Notes:** There are two specimens of Gamble at Kew, one of which has no collection details and was presented to Kew in 1925. The sheet bears an annotation by Gamble himself: "it is the *Bambusa wightii* of Munro, which is not *Teinostachyum wightii* of Beddome. I should call it *Ochlandra brandisii*". The identity of the specimen has been corrected by Fischer as *Ochlandra wightii* (Munro) Fischer.

At MH there are two specimens of Barber 7176 and 7178 identified as *Ochlandra travancorica* Benth. Fischer has corrected their identity as *Ochlandra wightii* (= *O. brandisii*).

## Acknowledgements

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